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RECENTLY PUBLISHED RESEARCH OF THE
INSTITUTE OF CHEMICAL PHYSICS,
ACADEMY OF SCIENCES USSR, MOSCOW

"Experimental Determination of the Probability of the Disappearance of Active Centers," A. B. Nalbandyan, Inst Chem Phys, Acad Sci USSR, Moscow

"CR Acad Sci URSS" Vol 47, 1945, pp 208-9

The introduction of pieces of metal wire into glass or quartz vessels markedly raises the lower ignition limit of combustible mixtures. The expression developed by Semenov, $(p\delta)^2 = 4B/\ln(d/\Delta)$ where p is the pressure at the lower limit of combustion, d is the diameter of the reaction vessel, Δ the diameter of the wire, and B a constant depending on the temperature, was confirmed for the mixture $2H_2$ plus O_2 at 464° . The lower limit of ignition in mm of Hg without a wire was 0.95 mm; for wire of diameter: 0.2 cm, 4.20 mm; 0.1 cm, 3.80 mm; 0.045 cm, 3.10 mm.

"A New Method of Gasification of Compressed Gases Under Pressure," Yu. N. Ryabinin, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Tekh Fiziki" Vol 15, 1945, pp 480-4

Liquid O is compressed by centrifugal force, evaporated under pressure, and the O gas is let out along the axis of the rotor.

**"Kinetics of Hydrogen Oxidation in the Region of
Lower Temperature Ignition: III. Influence of
Vessel Material,"** A. B. Nelbandyan, Inst Chem Phys,
Acad Sci USSR, Moscow

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"Acta Physicochimica URSS" Vol 20, 1945, pp 31-4

The experiments were designed to learn the effect of the walls of the reaction vessel on the temperature dependence of the induction period and of the quantity φ . The experiments were made with reaction vessels of stainless steel and of Durabax (glass) washed with a KCl solution. The temperature dependence of the induction period and the quantity φ do not depend on the material and condition of the walls of the vessel. The agreement between the observed and calculated values of the induction period is fairly good. With the steel vessel, measurements of the induction periods at higher pressures were unsuccessful, because the mixtures ignited on their way into the reaction vessel before the predetermined pressure was attained. The increase in the lower limit pressure in a Durabax vessel covered with KCl (and similarly for a stainless steel vessel) can be accounted for by assuming the probability of destruction of the active centers on the walls of a vessel covered with a KCl layer to be greater than the probability of destruction on the walls of a clean glass vessel.

"Decrease of Detonation Velocity in Rough Tubes,"
K. I. Shchelkin, Inst Chem Phys, Acad Sci USSR,
Moscow

"Acta Physicochimica URSS" Vol 20, 1945, pp 303-6

Detonation velocities of H_2 and O_2 , and C_2H_2 and O_2 are compared in rough and smooth tubes. Detonation waves were generated in a metal tube one meter long and propagated along a glass tube two meters long. A wire spiral was tightly fitted into the second half of the glass tube to assure roughness of the surface. The detonation waves were photographed on a moving film. Gives several tables of experimental data. The photographs show that the rate of combustion propagation is determined within broad limits by the state of the walls and the degree of roughness of the tube. The decrease in the propagation velocity of the detonation of a $H_2 + O_2$ mixture exceeds 40% of the velocity in a smooth tube; in a $C_2H_2 + O_2$ mixture the decrease was 30%.

"Fifteen Years of Activity of the Institute of Chemical Physics, Acad Sci USSR," S. B. Batner

"Zhur Fiz Khimii" Vol 20, 1946, pp 1225-6

Historical.

"Measurement of the Coefficient of Recombination of Atomic Hydrogen at Various Surfaces by a Determination of the Lower Limit of Ignition of the Mixture $2 H_2 + O_2$," A. B. Matkhanlyan, S. M. Snabina, Inst Chem Phys, Acad Sci USSR, Moscow

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"Zhur Fiz Khimii" Vol 20, 1946, pp 1249-59

The lowest total pressure p at which the mixture $2\text{H}_2 + \text{O}_2$ can be ignited at 440° is 1.05 and 7 mm Hg in glass vessels of 6.56 and 1.83 cm diameter. Filaments of other solids, 0.05-0.1 cm in diameter, raise p . The greatest increase was observed with ZnCr_2O_4 and graphite; both give $p = 10.3$ mm in a vessel that, alone, gave $p = 0.53$ at 490° . Au, W, Pt, and stainless steel show smaller increases of p . Untreated quartz raised p at 440° from 0.94 to 2.34, and quartz rinsed with HF raised p to 1.48. KCl did not affect p at 500° because of rapid evaporation. Pd and (above 390°) Pt catalyzed the combustion of H_2 so that p could not be measured. From the experimental p values of the coefficient ϵ of recombination of H atoms at various surfaces can be calculated. ZnCr_2O_4 and graphite have $\epsilon = 1.0$ at 490° , Au 0.098 at 440° , Pt 0.0089 at 388° , W 0.0057 at 540° , stainless steel 0.0028 at 440° , untreated quartz 0.0005 at 440° , quartz rinsed with HF 0.0003 at 440° , and pyrex glass washed with a $\text{K}_2\text{B}_4\text{O}_7$ solution 0.00002 at 440° . The pressure p in the presence of graphite was determined also at 530° and 558° ; from these values the energy of activation of the reaction $\text{H} + \text{O}_2 \rightarrow \text{OH} + \text{O}$ appears to be 17,800 calories. From the increase of the upper limit of ignition with temperature between 310° and 410° in a glass vessel washed with $\text{K}_2\text{B}_4\text{O}_7$ solution the activation energy of 18,000 calories is computed. All the above results agree with Semenov's theory.

"Photochemical Oxidation of Hydrogen: II. The Reaction at High Temperatures," A. B. Malbandyan, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1259-72

Mixtures of $2\text{H}_2 + \text{O}_2$ in a quartz tube were irradiated by a H discharge lamp. The rate v of formation of H_2O increased with the total pressure p (2-28 mm Hg) at $20-348^\circ$, and showed a maximum at 9 ± 1 mm at higher temperature ($368-385^\circ$). At 395° ignition took place between 7 and 12 mm Hg. Above 370° the photochemical reaction is complicated by the dark reaction, the rate of which increases linearly with temperature. At a constant pressure (20 mm) the ignition temperature in the darkness is 418° , and is lowered by the strongest illumination used to 391° . Near the ignition limit, v increases with temperature and the intensity of irradiation (I), and from those data the length of chains can be calculated. Below 380° this length is independent of I and equal to 2-4. Above 380° it is greater, the greater I . The maximum length of chain achieved before ignition takes place is 11 at the smallest, and 6 at the greatest I used. The very long chains postulated by Semenov near the ignition limit could not be detected. The effect of temperature and I on the chain length is in agreement with the mechanism postulated by Lewis and Elbe, "Combustion, Flames and Explosions of Gases."

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"Photochemical Oxidation of Hydrogen: III. A Theory of the Interaction of Chains," A. B. Nalbandyan, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1273-82

The lowering of the ignition temperature T by irradiation cannot be explained by the thermal effects of the irradiation because calculation shows these effects to be very small. A correct interpretation is given by supplementing the reaction mechanism postulated by Lewis and Elbe with the reaction $\text{HO}_2 + \text{HO}_2 = \text{H}_2\text{O} + \text{O}_2 + \text{O}$ in which two relatively inert radicals produce a new active atom. Then the rate of reaction depends on the original number, N_0 , of active centers. Irradiation lowers T because it creates new active centers, i.e., increases N_0 . If the coefficient of interaction of two chains is ρ , the ignition takes place when $\rho N_0 = 1$. The value of N_0 created by irradiation is calculated from the rate of the photochemical oxidation of H_2 at room temperature when the chain length is 1. From this value and the condition $\rho N_0 = 1$ at ignition, the lowering of T and the chain length at various irradiations are calculated in agreement with the experimental data.

"The Slow Oxidation of Hydrogen and the Third Ignition Limit," V. V. Voevodskiy, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1285-98

The mechanism of the combustion of H_2 postulated by Lewis and Elbe is supplemented by the reaction $\text{HO}_2 + \text{H}_2\text{O} = \text{H}_2\text{O}_2 + \text{OH}$. This reaction accounts for the acceleration of combustion caused by H_2O after a latent period and the absence of the acceleration in the beginning of combustion when the concentration of HO_2 is negligible. Calculation shows that, before H_2O can catalyze the combustion, the partial pressure of HO_2 radicals can exceed several mm Hg.

"The Reaction Between Hydrogen Atoms and Carbon," L. I. Avramenko, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1299

H atoms produced in a glowing discharge react at 100°C with soot. The reaction product shows a band at 4317 \AA indicating CH radicals.

"Thermal Reactions of Acetylene: II. The Explosive Decomposition of Acetylene," E. A. Blyumberg, D. A. Frank-Kamenetskii, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii", Vol 20, 1946, pp 1301-17

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The pressure p of C_2H_2 decreases during the course of one experiment according to the equation $(p_0 - p)/(2p - p_0) = kp_0(\tau - \tau)$, p_0 being the original pressure, τ time, τ the induction time, and k a constant. The value of τ is a few seconds. The energy of activation calculated from the variation of k between 450° and 660° is 29,900 calories per mole. The above equation is valid until over 50% of C_2H_2 has polymerized to a gaseous product. Later, a solid polymerization product forms, and the drop of p is more rapid. The explosion limits of C_2H_2 were determined between 574° and 872° in horizontal and vertical cylinders and in spheres. The explosion has thermal nature, gives C and H_2 but leaves also some C_2H_2 intact. It is assumed that the first stage of the explosion is formation of a dimer, and from the magnitude of the explosion limit it is concluded that this dimer is either cyclobutadiene or methenylcyclopropene.

"Thermal Reactions of Acetylene: III. A Kinetic Theory of the Formation of Acetylene at the Heat Decomposition of Methane," N. M. Znamenskiy, D. A. Frank-Kamenetskiy, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1319-23

By using Kassel's equation for the rate of formation of C_2H_2 from CH_4 , and the equation of Frank-Kamenetskiy for the rate of decomposition of C_2H_2 , the conditions (temperature and pressure) giving highest yields of C_2H_2 are determined. The yield should be greater the higher the temperature ($1,000-1,800^\circ$) and the smaller the pressure (76-760 mm Hg). The best duration of the reaction should be smaller, the higher are the temperature and the pressure.

"Initiating a Homogeneous Reaction in a Gas by Solid Catalysts," M. L. Bogoyavlenskaya, A. A. Koval'skiy, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1325-31

A solid catalyst can accelerate a reaction in the gas phase by emitting into the gas active atoms or radicals that initiate chains; this catalytic effect is analogous to photochemical initiation of reactions. A method is devised to show that a solid can accelerate a gas reaction, although the reaction takes place within the homogeneous gas phase, not on the solid surface. A thermocouple is placed along the axis of the reaction vessel and its readings are compared when the catalyst is (a) spread over the wall of the vessel, and (b) forms a coating on the thermocouple. If the reaction takes place on the catalyst surface, the temperature of the experiment (b) should be higher than in (a); and if the reaction is homogeneous, both readings should be identical. The identity of the two readings was observed for the reaction between CO and SO_2 in the presence of Al_2O_3 at 170-250 mm Hg (starting pressure) and $568-574^\circ$, the radii of the vessels being 14-19 mm. The reaction

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between SO_2 and H in the presence of Al_2O_3 also seems to be homogeneous. The oxidation of SO_2 in the presence of Pt is heterogeneous. The oxidation of H and of NH_3 on Pt seems to be partly heterogeneous.

"Heterogeneous Ionic Catalysis (Study of Esterification and Hydrolysis of Esters in the Vapor Phase)," V. I. Gol'danskiy, N. M. Chirkov, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1333-45

The reaction between EtOH and AcOH vapors at 75° in a glass vessel is immeasurably slow, but is much accelerated by HCl (1-56% of AcOH). In the presence of HCl the equilibrium between equimolecular amounts of EtOH, AcOH, EtOAc, and H_2O is reached at 92 molecular % of EtOAc. This makes measurements of the rate of esterification easier than that of hydrolysis. The rate of esterification up to 40% transformation is independent of time. This zero-order rate ν is proportional to the surface area of the glass, which was varied by inserting glass tubing. Therefore, the reaction is completely heterogeneous. The ν rapidly increases with p/p_0 , p being the total gas pressure and p_0 that pressure at which droplets appear on the wall. At $p/p_0 = 0.7$, ν is immeasurably small; at $p/p_0 = 1.0$ it is 10 times that at $p/p_0 = 0.8$. If the ν values at different temperatures ($45-82^\circ$) are compared at a constant p , the temperature coefficient of ν is negative. If the comparison is made at a constant p/p_0 , the temperature coefficient is positive and corresponds to an energy of activation of 15,000 cal/mol which is almost equal to that in the liquid phase. The exponential increase of ν with p/p_0 , the proportionality between ν and glass surface, and the agreement between the activation energies confirm the hypothesis that the reaction takes place in the liquid absorption layer. From ν the thickness of this layer is calculated to be 10^{-7} cm at $p/p_0 = 0.7$ and 10^{-6} cm at $p/p_0 = 0.8$. The above esterification is the first example of a heterogeneous catalysis in a multimolecular absorption layer.

"A Kinetic Method of Physicochemical Analysis: I. The Kinetics of the Reaction of Lead-Sodium Alloys With Ethyl Chloride Vapor," L. I. Avramenko, M. I. Gertser, M. B. Neyman, V. A. Shushunov, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1347-58

The reaction between EtCl gas and Pb-Na alloys gives PbEt_2 in about 80% yield. The measurable reaction starts after an induction period τ which is connected with the state of the alloy because EtCl transferred from an alloy after the end of the induction period to a fresh alloy required another τ , whereas an alloy specimen which was kept in contact with EtCl for τ hour immediately reacted with a fresh specimen of

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EtCl. At constant temperature and pressure, τ depends on the composition of the alloy (39-58 atmospheric % of Na) and shows a minimum at 50 atmospheric % Na. Hence, it is possible to detect the compound PbNa by kinetic measurements. τ is greater the smaller the pressure; e.g., at 20° in the presence of PbNa τ is 5 hours at 80, and 1.5 hours at 800 mm Hg. On a temperature rise, τ first decreases (e.g., from 5 hours at 20° to 0.6 hour at 35°) and then suddenly becomes very great. The temperature T at which the rapid increase of τ takes place is independent of the compound of the alloy and increases with the pressure of EtCl from, e.g., 20° at 100 and 58° at 1,600 mm Hg. Probably, the reaction has a chain mechanism, the breaking of chains has a greater temperature coefficient than the chain formation, and at T the rates of formation and breaking become equal.

"Combustion of Methyl Nitrate Vapor," Ya. B. Zel'dovich, Yu. Kh. Shaulov, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimi" Vol 20, 1946, pp 1359-62

Photographs of ignition of MeONO_2 vapor in a glass vessel by a spark show that a flame follows the spark after a time interval of 0.01 second for a vessel 15 cm in diameter, and 0.0035 seconds for a 5-cm vessel. It was concluded that the spark causes the reaction $\text{CH}_3\text{NO}_3 = \text{CO} + \text{H}_2\text{O} + 0.5 \text{H}_2 + \text{NO}$ which develops too little radiation to affect the photographic plate. However, this reaction raises the pressure within the vessel, and the heat of the adiabatic compression induces a second flame in which $0.5 \text{CO} + 0.5 \text{H}_2 + \text{NO}$ give $0.5 \text{CO}_2 + 0.5 \text{H}_2\text{O} + 0.5 \text{H}_2$. This mechanism was proved by experiments in a glass vessel separated from another vessel filled with inert gas by a thin membrane which broke during the first reaction and eliminated the adiabatic compression. There was no secondary flame in this arrangement. The gas after decomposition in the presence of a membrane contained even more than the theoretical amount of NO, and the gas after the second flame in a closed vessel contained only about 1% of NO.

"Thermal Decomposition of Barium Azide at Pressures up to 45,000 Kilograms/Square Centimeter," Yu. N. Prabinin, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimi" Vol 20, 1946, pp 1363-6

To achieve decomposition of a thin tablet of $\text{Ba}(\text{N}_3)_2$ within 3 minutes at atmospheric pressure, a temperature of 170° is required. This temperature rises with the pressure on the tablet: at 2,000 kg/sq cm it is about 210°, at 10,000 kg/sq cm about 225°, and at 45,000 kg/sq cm about 235°.

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"The Effect of the Physical Structure and the State of Aggregation on the Detonating Capacity of Explosives," A. Ya. Apin, V. K. Bobolev, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1367-70

Liquid TNT detonates only if the diameter of the specimen is above 32 mm TNT powder, compressed to the specific gravity of the liquid TNT, detonates at diameters of 2.1 mm and greater. Pieces of solid TNT are similar to liquid TNT. The minimum diameters are for liquid nitroglycerin and nitroglycerin powder 2.5 and less than 2 mm, respectively. Gas space between the explosive particles facilitates detonation, presumably because hot gases spread the detonation.

"Methods of Estimation of the Local Effect of Explosions," M. A. Sadovskiy, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1371-5

Testing explosives (amatol TNT, ammonal) by the impulse given to a pendulum gives results in agreement with testing by the compression of a Pb test piece. Different results are obtained when the charge is exploded on one face of a steel plate, and the impulse given to a steel ball touching the opposite face of the plate is determined. The older methods of measuring brisance do not give a correct idea of the local effect of explosions.

"The Mechanism of Detonation of Liquid Explosives. An Estimation of the Temperature Rise of Liquid Nitrates in the Shock Wave," S. B. Ratner, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1377-80

The temperature of nitroglycerin in which a shock wave progresses, is calculated. It can reach 3,000° and, consequently, is sufficient for propagation of the wave.

"The Combustion of Mercury Fulminate," A. F. Belyayev, A. E. Belyayeva, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1381-9

Hg(ONC)₂ compressed to density 3.8 burns when ignited instead of exploding. The rate of combustion, which at low pressures is not accompanied by a flame, can be measured by photographing Hg(ONC)₂ tablets at definite intervals. At 15°, the linear rate of the consumption of a tablet is $U = A + bp$. Here p is the pressure above the tablet. It is greater than the gas pressure before the ignition because the products

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of combustion require time to spread over the whole vessel. At very small initial pressures the additional pressure is about 40 mm Hg so that the combustion occurs at this p whatever the original degree of vacuum. If p is in kg per sq cm and U is in cm/sec, $A = 0.40$ and $b = 1.10$ between $p = 40$ and 760 mm Hg. The existence of the constant A presumably shows that some combustion takes place also in the pores of the tablet and that the gas pressure within these pores is about 300 mm Hg. The values of A and b increase when the temperature before ignition increases; at 105° they are about 50% greater than at 16° . The temperature of the surface of the burning tablet is about 500° . The results are discussed.

"Temperature Rise in the Surface of Burning Explosives,"
Z. I. Aristova, O. I. Leipunskiy, Inst Chem Phys, Acad
Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 20, 1946, pp 1391-7

Combustion of solid explosives takes place in two stages of which the first is gasification and the second, reaction in the gas phase. To estimate the heat liberation during gasification, burning nitrocellulose or nitroglycerin was rapidly extinguished and immediately thereafter introduced in a calorimeter. The heat content of a nitrocellulose surface was 2.5 ± 0.5 cal/sq cm, and of a nitroglycerin surface 2.8-4.5 cal/sq cm. A thermocouple pressed against the surface of nitroglycerin showed 520° . The heat capacity, heat conductivity, and the rate of combustion of the specimens used were measured.

"Theory of Detonation Spin," Ya. B. Zel'dovich,
Inst Chem Phys, Acad Sci USSR, Moscow

"CR Acad Sci URSS" Vol 52, 1946, pp 147-50

An attempt is made at a further elucidation of the spiral spreading of the detonation wave in dilute gas mixtures. On the basis of a limiting velocity (that of sound) the angle of the spiral and the pressure in the oblique wave can be computed.

"The Oxidation of Nitrogen in Combustion and Explosions," Ya. B. Zel'dovich, Inst Chem
Phys, Acad Sci USSR, Moscow

"Acta Physicochimica URSS" Vol 21, 1946, pp 577-628

The amount of NO formed in the explosion of mixtures of $F_2-O_2-H_2$, varying from 28% to 48% H_2 , and $C_2H_4-O_2-H_2$, containing 6-8% C_2H_4 , was maximum halfway between zero concentrations of H_2 and excess O_2 over the requirement for complete oxidation. NO yield was determined after explosion for mixtures of

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H_2 - O_2 - N_2 with N_2 equal to excess O_2 , H_2 -air, (90% CO -10% H_2)- O_2 - N_2 with N_2 equal to excess O_2 , and (90% CO -10% H_2)-air at 200 mm pressure and initial temperature from -160° to 320°. The equilibrium constant C' in the equation, $[NO] = C' \sqrt{[N_2][O_2]}$, where $[O_2]$ is the excess O after combustion, is independent of the H_2 and O_2 concentrations but is proportional to the combustible in the mixture. For the above experiments the curves of C' plotted as a function of the heat of combustion plus a correction for the sensible heat of the mixture coincide. The observed yields are 60-70% of the calculated thermodynamic equilibrium if the explosion temperature is corrected for the Maché effect for nonhomogeneous temperature distribution due to the time effect involved in the propagation of flame. A mixture of coal gas- O_2 -air was burned in a special inspirator, Venturi-type burner with an estimated temperature of 2,455° K. Samples of the gas at a series of points starting from the throat of the burner showed an increase in NO concentrations up to a maximum. The results confirm the thermal formation of NO from H_2 and O_2 as a result of the high temperature produced on oxidation of the combustible. The amount of NO on explosion of mixtures of 24% H_2 -38% O_2 -38% N_2 at 200 mm, with addition of varying amounts of NO up to 10 mm, was determined. Activation energies of 85 and 129 kg-cal per molecular were found for the heat of decomposition and formation, respectively. The dependence of the reaction velocity on O_2 concentration predicted by the chain mechanism was confirmed by experiments with excess fuel. The expression $d[NO]/dt = (5 \times 10^{-11} \sqrt{[O_2]}) e^{-16000/RT} [2/[O_2][N_2]] e^{-43600/RT} - [NO]^2$, with t in seconds and concentrations in molecules per l, was derived for the reaction velocity.

"Heterogeneous Catalysis in Multimolecular Adsorption Layers. Esterification Equilibrium in Two-Phase Systems," V. I. Gol'danskiy, Inst Chem Phys, Acad Sci USSR, Moscow

"Zhur Fiz Khimii" Vol 21, 1947, pp 431-8

The equilibrium constant K for the reaction $AcOH + EtOH \rightleftharpoons AcOEt + H_2O$ in liquid phase can be calculated from the equilibrium in the vapor phase and the vapor pressure of the constituents. The equilibrium in the vapor at 45-75° corresponds to 92% $AcOEt$, and the equilibrium constant is 30% at 45° and 19% at 75°. The correction for the association of $AcOH$, made by Hailford and Brundage, when calculating this constant is wrong. The calculated value of K does not agree with the experimental, presumably because the liquid is not an ideal mixture. The equilibrium in the presence of multimolecular adsorption layers must depend on the relative volumes of the gas phase and the adsorbed layers.

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"Reactions of Hydroxyl with Other Molecules: I.
The Reaction of Hydroxyl With Carbon Monoxide,"
L. I. Avramenko, Inst Chem Phys, Acad Sci USSR,
Moscow

"Zhur Fiz Khimii" Vol 21, 1947, pp 1135-42

A stream of H_2O vapor passed through a discharge tube in which OH formed was then mixed with a CO stream, and passed a heated reaction tube and then a receiver cooled with liquid air. The concentration of OH in the reaction tube was determined spectroscopically in the absence and the presence of CO; the difference gave the amount of OH which reacted with CO to give CO_2 and H. The reaction constant K for the disappearance of OH was $1.1 \times 10^{-10} \sqrt{T} \exp(-5000/RT)$ cc/sec between $T = 75^\circ$ and $T = 247^\circ$. The rate of reaction determined from the amount of CO_2 condensed in the receiver was much greater. It was shown that the H_2O vapor, after the discharge tube, contained atomic O and the reaction of O with CO was the main source of CO_2 .

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